REMARKS

We acknowledge the Examiner's indication that claims 62 and 63 would be allowable if written in independent form.

We have moved the limitation of claim 61 into claim 48 and canceled claim 61. Also, the heating layer was mislabeled as being made of a "thermally conductive" material instead of an "electrically conductive" material as it is described in the specification. So, we have also amended the claim to read "electrically conductive material" instead of "thermally conductive material."

Finally, we have also canceled claim 49 as redundant of limitations already found in claim 48. We ask the Examiner to enter the proposed amendments to the claims. Upon entering such amendments, claims 48, 51, 60, and 62-65 will be pending in this application.

The Examiner rejected claim 61 under 35 U.S.C. §103(a) as being unpatentable over U.S. 2002/0080493 to Tsai in view of U.S. 5,408,319 to Halbout. The Examiner admits that Tsai does not disclose a heater element. To supply this missing element the Examiner relies on Halbout and makes the following argument:

> Halbout also teaches that the Fabry-Perot filter is a thermally-tunable filter (col. 4, lines 6-40). The wavelength transmitted by the cavity is selected by thermally changing the index of refraction of silicon in the cavity. The temperature of the cavity is adjusted by passing a current in the proximity or in the cavity to provide ohmic heating (col. 4, lines 30-67). The contacts for the current to flow in a region of silicon layer (col. 4, lines 60-67) are considered to be the heater element.
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> Therefore, it would have been obvious to one of ordinary skill in the art to add a heater element in the multi-cavity thin-film structure disclosed by Tsai in order to provide a thermally tunable Fabry-Perot interference filter with which the wavelength passed through the filter can be efficiently selected by adjusting the cavity temperature, as taught by Halbout.

In short, the Examiner argues that it would have been obvious in light of Halbout to add a heater to the structure in Tsai. But Halbout's heater is a specific layer within the Fabry-Perot structure and that layer has specific requirements. More specifically, Halbout's heater layer is layer 18 which forms the spacer in the Fabry-Perot cavity. To heat the filter, Halbout passes current through that layer either in the cavity or in the vicinity of the cavity Col. 4, lines 39-41).

There is no structure in Tsai's device that has the characteristics of Halbout's spacer. Halbout's spacer is crystalline (i.e., epitaxially grown), it has uniform properties, and it is thick (50,000 – 100,000Å or 5-10 microns) (Col. 2, line 64 to col. 3, line 5). Moreover, Halbout's spacer layer must be as thick as it is to achieve the widely spaced transmission peaks (Col. 4, lines 28-33). That is, the change in the optical path length caused by the change in the index of refraction due to heating must be sufficiently large to produce meaningful shifts in the location of the pass band.

In contrast, the layers within Tsai's filter, including spacer layer 25, all have the same thickness, namely, $\lambda/4$ (e.g. 375 nm for 1.5 nm light). Thus, Tsai's spacer layer is over 13 times thinner than Halbout's spacer layer. Furthermore, Tsai's spacer layer has a special structure; it is a grating made up of alternating regions of high and low index material and for which the period length is about 1500 nm. The two materials are Si, which represents the high index of refraction material, and SiO_x, which represents the low index of refraction material (¶ 0021). SiO_x is non-conductive and so the alternating regions of SiO_x would not provide conductive paths for the current that Halbout passes through his layer to heat that layer. In short, a person of ordinary skill in the art would not be motivated to pass current through either of Tsai's spacer layers. Neither of Tsai's spacer layers would function effectively as a heater element since half of the material is electrically non-conductive and even if one could establish an electrical path through the layer, the layer is too thin to enable sufficient current to pass through for purposes of effectively heating the layer.

Heating Tsai's structure would not cause meaningful shifts in the location of the pass band because the spacer layer is too thin. Meaningful shifts require that the change in effective optical path length be sufficiently large. The change in optical path length is equal to $\Delta n \cdot L$, where Δn is the change in index of refraction and L is the thickness of the layer. Since L in the Tsai device is over 13 times smaller than the L in the Halbout device, the resulting shift for the same ΔT could be no greater than an amount that is at least 13 times smaller than what is achievable in the Halbout device. In addition, since Tsai's spacer layer is a mixture of low and high index materials (i.e., Si and SiO_x) the effective change in the index of refraction for that layer will necessarily be much less than what is achievable for a layer made of just Si. So, all of these factors combined make it clear that meaningful shifts could not be achieved in the Tsai

device. So, there would be no motivation to heat the Tsai structure by any means, let along by passing a current through the spacer layer.

One of ordinary skill in the art would not be motivated to use a thicker spacer layer in the Tsai structure because the thin layer is required to achieve the objectives for which Tsai's structure was designed. For example, Tsai notes that one objective was to achieve a smaller thickness so as to reduce errors and production costs of the thin film coating (see ¶ 0006). Increasing the thickness of that layer to what is required by the Halbout structure runs counter to that objective. Indeed, the thickness of the spacer would have to be increased by a factor of at least 13 which would make the spacer layer by itself almost as thick as Tsai's disclosed structure (see Fig. 2A) thereby substantially increasing the overall thickness of the filter appreciably.

Also, it is clear that limiting Tsai's spacer layer to a thickness of $\lambda/4$ is an important requirement of Tsai's invention. Claim 1, which is the only independent claim in the Tsai patent, recites "the high refraction index layers, the low refraction index layers, and the resonance grating are all $\lambda/4$ thick." In other words, increasing the thickness of that resonance grating layer to make it comparable to the corresponding layer in the Halbout device would be contrary to an important requirement of Tsai's claimed invention. Thus, a person of ordinary skill in the art in light of the teachings of the Tsai patent would not be motivated to make such a modification.

In addition, neither Tsai nor Halbout discloses a way to electrically connect to either of Tsai's spacer layers 25. Without the ability to electrically connect to those layers, one would not be able to pass current through them, as is done by Halbout. Note that Tsai's spacer layer is the fifth layer of a thin film stack that is deposited onto a supporting substrate. Whereas, Halbout's thin film mirrors are deposited on opposite surfaces of a much larger and thicker crystalline spacer to which electrical contact can easily be made at locations that are outside of the area onto which the mirrors are fabricated.

One could not use Halbout's fabrication methods to construct Tsai's filter. Tsai's spacer is too thin to function as Halbout's layer 18 onto each side of which thin film structures would subsequently be deposited.

For the reasons stated above, we submit that claim 48 as amended and the claims dependent therefrom are allowable over the art of record and therefore ask the Examiner to allow the claims to issue.

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Respectfully submitted,

By______________________

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